

Combustion Initiative for Innovative Cost-Effective NO_x Reduction

Participant

Alliant Energy Corporate Services, Inc.

Additional Team Members

Wisconsin Power & Light Co.—host

Reaction Engineering International—modeling

Electric Power Research Institute—technology supplier

Locations

Sheboygan, Sheboygan County, WI (Wisconsin Power & Light's Edgewater Generating Station, Unit No. 4)

Technology

Combustion Initiative modifications for cyclone coal-fired boiler technology using a Computational Fluid Dynamic (CFD) System Model to reduce NO_x emissions, which include a redesign of the cyclone re-entry throats, an upgrade of the gravimetric feeder controls, and chemical reagent injection.

Plant Capacity/Production

340 MW

Coal

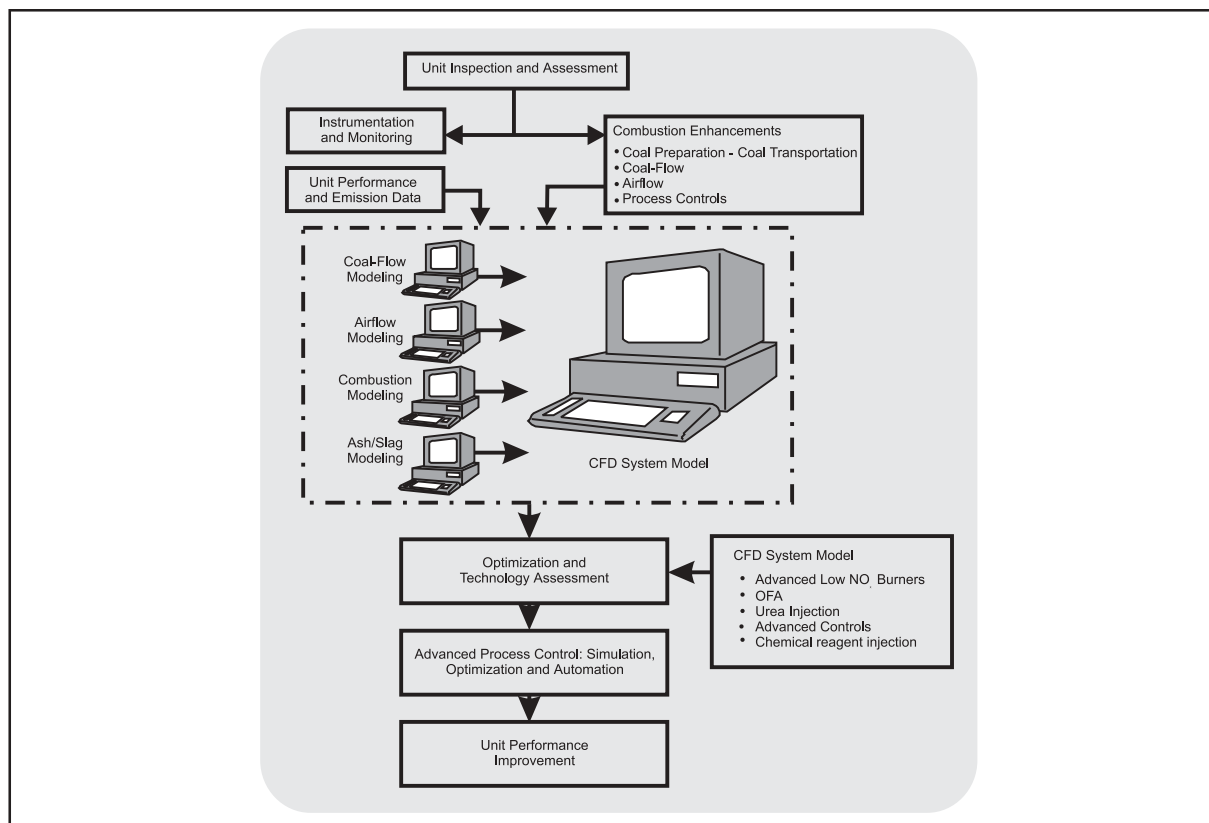
Powder River Basin Coal (85%) and Kicker Coal (15%)

Project Funding

Total Project Cost	\$7,397,718
DOE	3,698,859
Participant	3,698,859

Project Objective

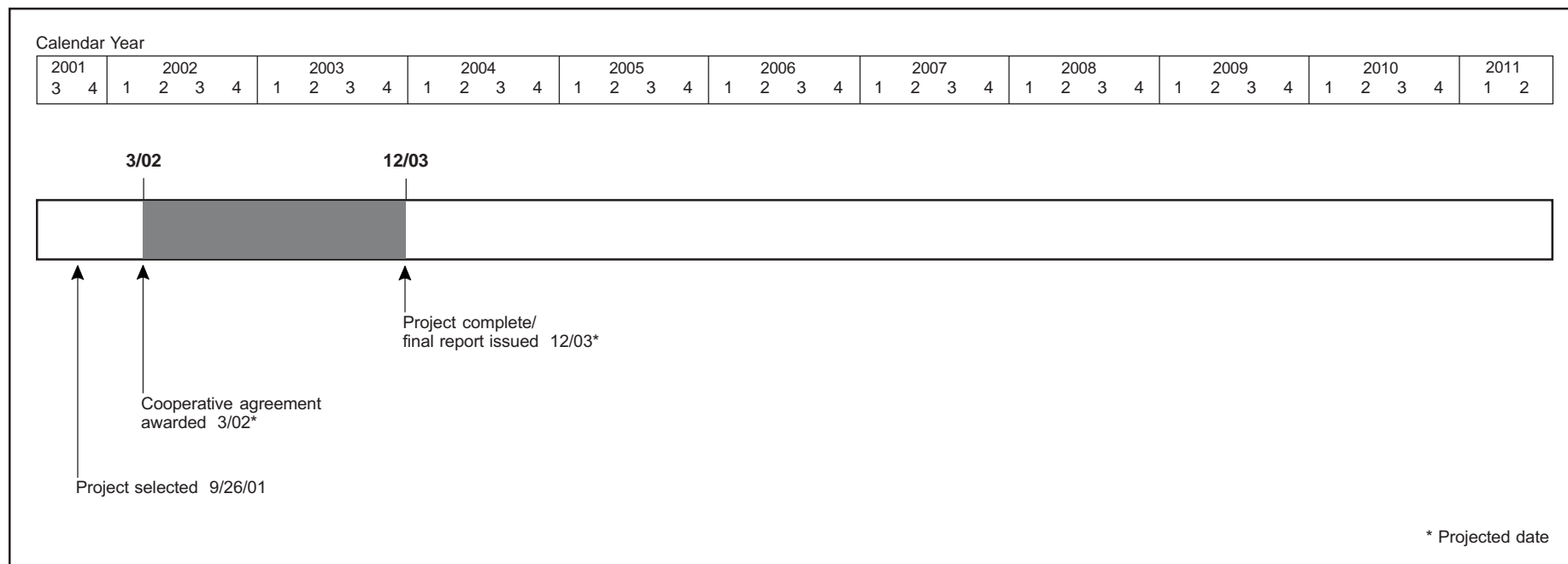
To achieve the same, stringent nitrogen-oxide-emissions reductions as selective catalytic reduction (SCR) at a fraction of the capital cost and with drastically lower operation and maintenance costs. Participant uses a computational modeling approach, its Combustion Initiative, to optimize overall power plant NO_x performance. The



Combustion Initiative will attempt to hold NO_x emissions to 0.15 lb/10⁶ Btu from a 340-MW cyclone boiler. Cyclone boilers are especially prone to high NO_x emissions; this demonstration could help establish a target baseline for combustion-stage NO_x reductions on cyclone boilers.

Technology/Project Description

The Combustion Initiative is a method that starts with developing a deep understanding of the combustion and related processes in each piece of equipment and in the power plant as a whole. The second step is to push the envelope for existing NO_x control technologies through re-engineering and modeling. The use of computational modeling as a tool is key to optimizing the system performance and maximizing the use of emission reduction technologies. The Combustion Initiative method results in the potential to reduce NO_x emissions to 0.15 lb/10⁶ Btu or below, without the use of SCR technology.



Project Status/Accomplishments

The project was selected for award on September 26, 2001. The Department of Energy selected this project for a partial award for demonstration on a cyclone boiler only. Contract negotiations are under way as of the end of fiscal year 2001.

Alliant Energy proposes, through its Wisconsin Power & Light Company subsidiary, to demonstrate the reduction of NO_x emissions using the Combustion Initiative method on three of the main coal-fired boiler types in the United States: tangentially fired, cyclone-fired, and wall-fired units. The three units include Edgewater Generating Station Unit No. 4 (cyclone) and Unit No. 5 (wall-fired) in Sheboygan, Wisconsin, and Columbia Generating Station Unit No. 2 (tangentially fired) in Portage, Wisconsin. Better thermal efficiency will mean that less fuel will be needed to produce energy, which saves money and reduces stress on equipment. Improved reliability will help keep customers lights on, even as demand grows throughout the region. Finally, when costs are minimized, shareowners experience increased earnings. Through applied science and technology, the Combustion Initiative

is helping Alliant Energy find cost-effective solutions to challenges the power industry faces today and tomorrow.

The ability to reach these low NO_x emission levels has been demonstrated in the pilot-scale work that Alliant Energy has conducted at its M.L. Kapp Station in Iowa. This facility lowered its NO_x emissions from 0.35 lb/10⁶ Btu to 0.15 lb/10⁶ Btu using the Combustion Initiative Method.

Commercial Applications

Alliant Energy's Combustion Initiative is a science-and-technology—driven approach to lowering emissions and improving the performance of coal-fired power plants. Through research and development, the company is finding innovative ways to reduce emissions, increase thermal efficiency, and improve plant reliability. This technology has potential application to all 89 cyclone-fired boilers, having an installed capacity of 27,600 MWe. If successfully demonstrated, the relatively low capital cost of the CFD-based technology and the high potential NO_x reduction should result in significant market penetration.

The Wisconsin Department of Natural Resources (WDNR) has designated Sheboygan as a "Primary Ozone Control Region." The Edgewater site is located within this region. The WDNR regulations call for reduction of NO_x emissions from utility boilers during the May through September "ozone season." Under these regulations, the Edgewater site is required to reduce NO_x emissions to 0.33 lb/10⁶ Btu by 2003 and to continue to progressively reduce emissions to 0.28 lb/10⁶ by 2008.